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Impact of agricultural management on pluvial flash floods – Case study of an extreme event observed in Austria in 2016

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Central Europe was affected by extreme flash floods in summer 2016 triggered by short, high-intensity storm cells. Besides fluvial runoff, local pluvial floods appear to increase recently. In frame of the research project SAFFER-CC (sensitivity assessment of critical condition for local flash floods – evaluating the recurrence under climate change) surface runoff and pluvial flooding is assessed using a coupled hydrological/2D hydrodynamic model for the severely affected municipality of Schwertberg, Upper Austria. In this small catchment several flooding events occurred in the last years, where the most severe event occurred during summer 2016. Several areas could only be reached after the flood wave subsided with observed flood marks up to one meter. The modeled catchment is intensively cultivated with maize, sugar beets, winter wheat and soy on the hillside and hence highly vulnerable to water erosion. The average inclination is relatively steep with 15 % leading to high flow velocities of surface runoff associated with large amounts of transported sediments. To assess the influence of land use and soil conservation on flash floods, field experiments with a portable irrigation spray installation were carried out at different locations. The test plots were subjected to rainfall with constant intensity of 100 mm/h for one hour. Consecutively a super intense, one hour lasting, rainfall hydrograph was applied after 30 minutes at the same plots, ranging from 50 mm/h to 200 mm/h. Surface runoff was collected and measured in a tank and water samples were taken to determine the suspended material load. Large differences of runoff coefficients were determined depending on the agricultural management. The largest discharge was measured in a maize field, where surface runoff occurred immediately after start of irrigation. The determined runoff coefficients ranged from 0.22 for soy up to 0.65 for maize for the same soil type and inclination. The conclusion that runoff is heavily influenced by land use matches well with the observed flow patterns during the storm event in summer 2016. The results clearly indicate the ability to reduce pluvial flash flood impacts by changing agricultural management practices.